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September 8, 2000

Mississippi River/Gulf of Mexico Action Plan (4503F)
c/o U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW, Room 4503 F
Washington, DC 20460

Comments of the American Farm Bureau Federation on the Draft Plan of Action for Reducing, Mitigating and Controlling Hypoxia in the Northern Gulf of Mexico

The American Farm Bureau Federation represents a great portion of the hundreds of thousands of farm and ranch families that live and work within the Mississippi River Basin. These families and their communities could face huge potential negative impacts based on EPA's Draft Plan of Action for Reducing, Mitigating and Controlling Hypoxia in the Northern Gulf of Mexico.

Although we have many technical concerns about the action plan, the most critical issues are:

1. the adequacy of scientific analysis,
2. the use of water-quality standards and TMDLs to protect the Gulf;
3. the effects of a 20 to 40 percent nitrogen reduction goal on agriculture,
4. the impact of river flow management on the hypoxic zone and other resources,
5. the lack of any economic and social analysis, as required by law,
6. the composition of any task force that might continue to exist after the Action Plan has been finalized and
7. the lack of substantive involvement of state governors in the action plan.

1. Adequacy of Scientific Analysis
We continue to be concerned about the adequacy of the scientific analyses which are being used as a basis for the action plan. For instance, in section 2.2.1 of the Committee on Environment and Natural Resources (CENR) Topic Report 6 it was originally erroneously reported that:

> "A 1994 report to Congress (EPA, 1994) indicated that 23% of rivers surveyed, 43% of lakes and 47% of estuaries were impaired by nutrient enrichment. Two years later, the 1996 National Water Quality Inventory, reported even higher levels of nutrient impairment, 40% of surveyed rivers, 51% of surveyed lakes and 57% of estuaries. Agriculture was identified as the most widespread source of pollutants...."

This incorrectly blamed nutrients and, by association, agriculture, for damaging 2.5 to 2.8 times more water bodies than was really true based on the numbers in the EPA's 1994 and 1996 National Water Quality Inventories. The paragraph should have read as follows:

> "A 1994 report to Congress (EPA, 1994) indicated that in the nation's surveyed water bodies, 8% of surveyed rivers, 17% of surveyed lakes and 17% of surveyed estuaries were impaired by nutrient enrichment. Two years later, the 1996 National Water Quality Inventory, reported even higher levels of nutrient impairment, 14% of surveyed rivers, 20% of surveyed lakes and 22% of surveyed estuaries. Agriculture was identified as the most widespread source of pollutants...."

We informed the chief author of the report and to the report managers about these serious factual errors and were promised that a correction would be forthcoming. However, both the final printed version, and the current (July 2000) internet version still contain the original errant language, with no indication of a correction.

Errors of this magnitude need to be corrected before any further work is done on the Action Plan.

Blue Baby Syndrome
In the third paragraph under the section "Background on the Issue" the draft Action Plan states, "In some areas groundwater supplies are threatened by excess nitrate, which can be a human health hazard." We believe this sentence should be removed from the Action Plan as new information shows that the nitrates are not a causal factor in developing infantile methemoglobinemia (blue baby syndrome) "Infantile Methemoglobinemia: Reexamining the Role of Drinking Water Nitrates." A.A. Avery. 1999. Environmental Health Perspectives Volume 107, Number 7, July 1999, pages 583-586. We recommend that EPA revisit the nitrate standard for drinking water and revise the standard in light of the new information.

2. Nutrient Standards to Protect Gulf/TMDLs
The draft action plan includes language that the states will adopt water-quality standards for nutrients, including criteria for nitrogen that are tailored to the coastal ecoregions of the Northern Gulf of Mexico. The action plan also states that "The work of the Task Force has provided **a basin wide context for the continued pursuit of** both incentive-based voluntary efforts for nonpoint sources and **regulatory controls for point sources.**"

The development of nutrient criteria is a separate, but closely related, effort by the USEPA. The current plan is that the USEPA will publish criteria for nitrogen and phosphorus in December of this year and the states will have three years to adopt water-quality criteria for those nutrients. If a state fails to adopt nutrient standards, the USEPA will promulgate standards for that state. The draft action plan has caused significant confusion amongst the states about who is setting what criteria. It was clear from a recent water quality criteria meeting conducted by one of EPA's Region offices that even headquarters staff from USEPA who participated in the meeting did not know what the implications of the Draft Action Plan for Hypoxia were on the nutrient criteria development and what the interrelations of the Action Plan were to the development of nutrient criteria. It was clear to the state agency staff attending the meeting that the water quality standards that might be imposed upon them if they had to set criteria or standards based on some goal for the Gulf of Mexico would be significantly more stringent than those they would develop to protect designated uses of their state's waters.

The Integrated Assessment discusses using a criterion of 1.5 mg/L of total nitrogen for rivers and streams. While this number is not mentioned specifically within the Action Plan, it appears that a standard for nitrogen will be primarily based on impacts to the Gulf. However, the hypoxic zone in the Gulf is attributed to stratification of the water, due to freshwater inflows, as well as to excess nutrients, primarily nitrogen. Perhaps there should also be a standard for how much fresh water is allowed enter the center of the hypoxic zone.

Meanwhile, in fresh water systems, phosphorus is the nutrient that states have been most concerned with because it most often controls algal growth. If the water quality programs in the individual states are to be directed by the states and address in-state priorities, excessive phosphorus and sediment are probably the primary nonpoint source pollutants of concern in targeting state resources. Although the control of phosphorus has recently been added to the Action Plan and the Plan includes a within Basin goal to restore and protect the waters of the 31 states and tribal lands within the Basin and their aquatic ecosystems, the overriding thrust of the Plan is the control of nitrogen.

A nitrogen standard for salt water may be entirely incompatible with a nitrogen standard for fresh water. Using a total nitrogen standard of 1.5 mg/L, the authors of the CENR Topic 4 report estimated that the proposed criterion would be exceeded in 16 percent of the subwatersheds in the Tennessee River basin, 40 percent in the Ohio River basin, 35 percent in the lower Mississippi River basin, and about 70-75 percent in the Upper Mississippi, Arkansas-Red Rivers and Missouri River basins. The requirement that TMDLs ensure compliance with standards will, in many cases, place the burden on states to develop TMDLs solely to meet goals for the Gulf of Mexico. There is some question as to whether a state has legal authority to adopt standards to protect out-of state waters.

3. 20 to 40 Percent Nitrogen Loading Reduction Goal.

One possible goal stated in EPA's Draft Plan of Action proposes a reduction of 20 to 40 percent in loading of total nitrogen in the Mississippi River. EPA's main assumptions are that nitrogen fuels hypoxia and that agricultural cropland, particularly corn farms in the Midwest, is responsible for the bulk of the nitrogen in the river. Reconstructing wetlands and riparian forests are part of the Action Plan's proposed solutions for reducing nitrogen loading in the Mississippi River. Although not specified in the draft Action Plan, the Integrated Assessment lists the restoration of 5 million acres of wetlands within the entire Mississippi River Basin as one approach to achieving a 20 percent reduction in nitrogen loading to the Gulf. The Integrated Assessment states that this would only be 0.7 percent of the entire Mississippi River Basin. However, the Committee on Environment and Natural Resources (CENR) Hypoxia Topic Reports, the Integrated Assessment and the Draft Action Plan unrealistically minimize the impact on cropland of wetland and riparian forest reconstruction.

The CENR Topic 5 Report states that it would only take 0.71 percent of the total land area in the Mississippi River Basin to install enough wetlands to cause a 20 percent reduction in nitrogen loading of the river. However, the authors of the Topic 5 Report state that the most effective distribution of wetlands and riparian areas within the basin will be between farmland and the streams and rivers, particularly in basins where concentrations of nitrogen in subsurface drains is the highest. However, little, if any, mention has been made of the fact that nearly two-thirds of the entire basin is Noncropland, consisting of woodlands, urban areas, and permanent pasture or rangeland. These areas will not likely to be used for wetland or riparian forest restoration. Existing woodland and urban areas will not be destroyed to recreate wetlands. Neither is it likely that range and pasture will be used because they are in geographic areas of the country that do not contribute much nitrogen to the rivers and/or are often in unusable landscape positions (uplands) to have much impact. Therefore, cropland will be the main source of land used for wetland or riparian forest reconstruction.

The attached table adapted from CENR Topic 3 and 5 Reports, shows the potential impacts on cropland by depending entirely upon wetlands, riparian forests or a combination of wetlands and forests to reduce the nitrogen loading by 40 percent from 42 individual subwatersheds. The burden for reconstructing wetlands and riparian forests would fall almost entirely upon cropland farmers. Within the entire Mississippi River Basin, a nitrogen loading reduction goal of 20, 30 or 40 percent dependent entirely upon reconstruction of wetlands and riparian forests would require converting cropland area equivalent to 30,811, 46,217 or 61,623 average-sized farms, respectively.

In most counties in Iowa this would require at least 6 percent and as high as 33 percent of the cropland in the county to be converted. In one watershed in Pennsylvania it would require an additional 189,000 acres of cropland outside of the watershed in order to install enough wetlands to reduce their share of the total nitrogen contribution by 40 percent.

In some key agricultural watersheds in Iowa and Illinois, from 8 percent to as high as 36 percent of existing cropland would be needed to construct wetlands and riparian forests to reduce that watershed's share of nitrogen loading by 20 to 40 percent, respectively. These are averages based on nitrogen concentrations and flow measured at the outlets of these sizeable watersheds. The average assumes that each acre of land contributes the same amount of nitrogen to the total flow as the next acre of land. While this is a faulty assumption, it is the only assumption that can be made from the information contained in the CENR Hypoxia Topic Reports.

Meanwhile, modeling work by U.S.G.S. (Smith et. al. 1999) indicates that depth of the stream may have significant impact on the amount of nitrogen that ultimately is carried all the way to the Gulf of Mexico from a given area or source. Model results are suggesting that the closer the source of nitrogen is to a deep stream or large river, the greater the chance that more of the nitrogen will end up in the Gulf. In other words, nitrogen deposited directly in the Ohio River by a city in Pennsylvania probably has a greater chance of reaching the Gulf of Mexico than does nitrogen originating from a field in Iowa that has to travel through miles of shallow ditches and streams before reaching a large river.

The issues in this section clearly indicate that EPA has not discussed the issue of cropland conversion with agricultural stakeholders and has not lived up to the requirement of the law to analyze the social and economic impacts of its proposed goals and policies. The information from U.S.G.S points up the fact that much more work needs to be done to determine assimilative capacity of streams before EPA blindly throws a blanket numeric nitrogen load reduction goal onto the Mississippi River Basin.

Standards vs. Goals

The EPA's discussion of a total nitrogen standard water quality standard (presumably the 1.5 mg-N/L mentioned in the Integrated Assessment.) and up to 40 percent reduction in nitrogen loading are two entirely different approaches that obscure real impacts on upstream watersheds. For example, a goal of 40 percent reduction in loading of nitrogen the Mississippi River would translate into reducing total nitrogen concentration from an flow weighted average concentration of 12.8 mg/L in the Raccoon River watershed located in west central Iowa, down to an average of 7.7 mg/L. On the other hand, a water quality standard of 1.5 mg/L would require an 88 percent reduction in the flow weighted average total nitrogen concentration in the Raccoon River. A goal of 20 to 40 percent reduction in nitrogen loading would require conversion of up to 430,500 acres of croplands into wetlands and riparian forsets in the Raccoon River Watershed. An 88 percent reduction using the suggested 1.5 mg-N/L standard would require nearly one million acres of cropland to be converted. Either approach would have significant economic and social consequences in the watershed. The Action Plan is required by law to define and address these consequences, but EPA has failed to do this.

It also shows the futility of setting numeric goals for a large river basin, especially when they are unfounded goals where everyone is assumed to be equally responsible and yet the government's own publications show that a great variation exists from watershed to watershed.

4. Impact of River Flow Management on Hypoxic Zone and Other

Short term Action # 9 in the draft action plan calls for a reconnaissance level assessment by the Corps of Engineers (COE) of potential nutrient reduction actions that could be achieved by modifying Corps projects or project operations by the fall of 2003. We strongly urge that this activity be completed on a much more timely basis by the summer of 2001, so that results can be used to make informed decisions about the other nine short term actions. As we noted in AFBF's comments on the Intergrated Assessment it appears technically possible to manage river flow in such a manner that it could reduce total load of nitrogen delivered to the hypoxic zone. New information developed by Don Goolsby for the Science Meeting in December of 1999 in St. Louis indicates there may be a potential correlation between the size of the hypoxic zone and the river flow during the months of May and June. This needs to be studied and related to management of river flows and its impact on other resources. The legislation required that all options be studied, but this issue has not been investigated.

5. No Cost/Benefit Analysis

The legislation which created the Task Force (PL 105-383) **requires that the President, *in conjunction with the chief executive officers of the States,* submit a plan to address Gulf Hypoxia, including a description of the social and economic costs and benefits. Currently, the Action Plan does not include a description of the social and economic costs and benefits.**

The Integrated Assessment states: "**The benefits of a program to reduce nitrogen loads to the Gulf are difficult to quantify.** Although there are known impacts to the Gulf ecosystem, an economic analysis based on past data did not detect a direct relationship between hypoxia and

Gulf fisheries. The information to estimate the benefit value for such actions as restoring the ecological communities in the Gulf or improving the water quality in the Basin is not available" (Integrated Assessment, page 44). The Topic 6 Report concludes that *"... **the direct measurable dollar benefits of Gulf fisheries of reducing nitrogen loads from the Mississippi River Basin are very limited at best"**.*

"**Social costs would also be incurred,** such as dislocation in land use, agribusiness infrastructure, and farm communities. We can tell in some cases, and infer in others, where we might begin to incur unacceptable costs of this kind on the basis of historical shifts in crop production, land use, and input use. **We did not estimate these costs.**" (Topic 6 Report) Also, the analysis does not discuss the impacts on local units of government in areas where large amounts of cropland are taken out of production. For example, in Illinois, property taxes on wetland acres would be only 1/6th of the taxes on cropland.

The economic impact analysis did not address economic impacts within specific states or watersheds. However, the report concludes that **"Severe restrictions on nitrogen loss from agriculture mean that production ceases on acres in the Mississippi River Basin that are especially vulnerable to nitrogen loss"** (e.g., the Iowa, Illinois, Indiana, Ohio, southern Minnesota). Neither the economic analysis nor the Integrated Assessment address the comparative costs and benefits of the Gulf hypoxia issue. The Integrated Assessment states that the fisheries of the Gulf generate $2.8 billion annually. In 1997, the five Midwestern states identified as the largest contributors to nitrogen losses exported nearly $14 billion in agricultural commodities; total cash receipts were more than $41 billion.

USEPA is pushing for a final strategy by October. We believe that enough questions have been raised recently to indicate the need for additional time to reconsider this issue and the proposed solutions. Across the Mississippi River basin, local, state and federal agencies, the agricultural industry, and farm and environmental organizations are implementing many programs to reduce nutrient impacts on water resources. Additional time for further evaluation of the causes of the hypoxic zone and detailed assessments of the impacts of proposed solutions on various states and industries is needed and reasonable. Prior to any attempt to adopt a quantitative goal, USEPA should provide funding to each state for detailed studies of the social and economic costs and benefits within each state and for state-level assessments of the feasibility of the solutions included in the Action Plan.

6. Realignment of the Mississippi River/Gulf of Mexico Nutrient Task Force.
Regarding the implementation actions and the assumption of a continuation of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, we recommend that if this effort is to be continued, the makeup of the group needs to be substantially revised. The revisions would be along the lines to bring in decision making input from outside the government. Currently the Task Force is made up of exclusively governmental representatives, state and federal, with the only exception being two tribal representatives. Given the magnitude and the scope of the issues that need to be addressed in the future, we strongly recommend that the group dealing with the hypoxic issue include representatives beyond government.

We would suggest that the following committee make-up be considered:

Number of Representatives	
4	State Agriculture Departments
4	State Environmental Departments
2	Tribal
	Federal Government Representatives
1	Office of Science and Technology – Executive Office/President
1	U.S. Army/Corps of Engineers
1	USDA
1	Dept. of Commerce/NOAA
1	Dept. of Interior
1	Dept. Fish, Wildlife & Parks
1	EPA
4	Agricultural Organizations
2	Municipal Water Utilities
2	Business and Industry
2	Scientists (Agricultural scientist with agronomy background, and marine scientist unaffiliated with current Gulf hypoxia programs)
27	

This would expand the committee from its current size of 21 to 27. Fifteen slots would be allocated to federal/state government representatives and 10 slots to non-governmental representatives, with the remaining for tribal representatives.

7. Submission of the action plan and state government involvement
Although the law states that the President submit the plan "in conjunction with the chief executive officers of the States", the USEPA has indicated that it does not anticipate that the action plan will be submitted to the governors of the 31 affected states for their concurrence. Many of the eastern states in the basin are unaware of the potential impact the action plan could have on cropland in their state. It would be inappropriate to bypass the governors of the states involved.

Adaptive Management
Using adaptive management as suggested in the action plan means the regulators will squeeze regulatees one way this year, and, if they don't like the results at the outflow of the Mississippi River, they will whipsaw regulatees another way next year. Individuals will have little or no choice in the matter and no chance to prove their innocence.

Effects of nitrogen-reduction goal on point sources and agriculture
Because point source dischargers must meet water-quality standards, it is likely that every municipal wastewater treatment plant will be required to provide tertiary treatment to reduce nitrogen at a cost of billions of dollars. (The average total nitrogen concentration in wastewater effluent is about 16 mg/L.) We are very concerned that this obvious economic impact on urban areas will increase political pressure on the states or local units of government to adopt regulations for the control of nonpoint sources of nitrogen. The American Metropolitan Sewerage Association is already on record supporting USEPA authority over nonpoint sources. However, the U.S.G.S. work mentioned above, indicates that point sources far upstream on the large rivers may be contributing a much higher proportion of their nitrogen flux to the Gulf compared to agricultural areas that drain through shallow ditches and streams before entering a larger river.

Effects of nitrogen-reduction goal on agriculture
Some row-crop producers may be able to reduce nitrogen losses by 10 to 15 percent with BMPs, such as rate and timing, without effecting yields. Others who have already fine-tuned their nitrogen inputs as low as they dare, do not have that option. But a wholesale change from fall to spring application and creating millions of acres of wetlands or riparian areas on such a large scale could have tremendous impacts. The burden of wetland and riparian forest reconstruction will fall almost entirely upon existing cropland.

Upstream and Downstream Issues
We note on page 5, the draft action plan alludes to another issue. For example, the report says, "The hypoxic zone is a result of complicated interactions involving excessive nutrients, primarily nitrogen, carried to the Gulf by the Mississippi and Atchafalaya Rivers; physical changes in the basin, such as channelization and loss of natural wetlands and vegetation along the banks as well as wetland conversions throughout the basin; and the stratification in the waters of the northern Gulf caused by the interaction of fresh river water and the saltwater of the Gulf."

While the report alludes to issues involving the rivers, relatively little is mentioned in the implementation actions. While action items #4, #5 and #6 allude to some actions with regard to the Mississippi/Atchafalaya River Systems, it appears most of these efforts are devoted to upstream issues. We would suggest that it is imperative that actions regarding the flow rates between the Mississippi/Atchafalaya Rivers, the restoration of delta marshlands and other issues relative to the rivers flowing into the delta be given at least equal emphasis to the efforts aimed upstream. Much of the work presented in the topic reports suggests these issues are just as important as those issues related to upstream watersheds and agricultural lands. By putting equal emphasis on both upstream and downstream issues, the implementation action recommendations would signal a truly cooperative effort to solve the hypoxic issue for all parties involved.

Quantitative Nutrient Reduction Goals
Every state within the Mississippi River basin has made great progress in controlling soil erosion and addressing in-state water-quality problems from both point and nonpoint sources. But without a higher level of confidence about the science behind the Action Plan and greater knowledge about the potential impacts of the proposed solutions on agriculture and point sources, we continue to oppose the adoption of quantitative goals.

Conclusions
We would like to acknowledge and thank the many people who have contributed to this effort over the past three years. The task force's work has outlined basic parameters of the hypoxia issue and raised many questions and identified research that needs to be pursued to answer these questions.

While it is a useful start to a challenging issue, we would caution the task force that we are closer to the beginning of the journey to deal with the issue than to the end. As several scientists indicated at the last task force meeting, sufficient data and information to set quantitative goals is simply not available at this juncture. So, it is imperative that a plan be set forth to develop this data and information. All indications are that work should be sub-divided on a watershed by watershed basis. Voluntary programs that include farmers, agronomists, hydrologists, and marine and aquatic scientists in both the upper and lower portions of the Mississippi River Basin will promote the cooperative effort necessary to best address this issue in the future.

Sincerely,

Richard W. Newpher
Executive Director
Washington Office

Impact on Cropland of Reconstructing Wetlands and Riparian Forests to Reduce Nitrogen Loading in Mississippi River by 40%

A	B	C	D	E	F	G	H	I	J	K
B	Table 4.3	Table 4.3	Formulas	B/15*0.4*247	B/4*0.4*247	(B/2/15*0.4*247) +	Table 2.3	Table 2.3	H*I*247/100	G/J*100
A	Topic 3 CENR	Topic 3 CENR		(a)	(b)	(B/2/4*0.4*247)	Topic 3 CENR	Topic 3 CENR		
S	Total	Total		Wetlands	Riparian	Combination	Land	Percent	Cropland	Percent of
I	Nitrogen	Nitrogen		Only	Forests	Wetlands	Area	Cropland		Cropland
N	Flux	Yield		40% reduc.	Only	& Forest for	in km2		Acres	Needed for
	Metric				40% Reduc	40% Reduc.				Combination
ID	Tons			Acres	Acres	Acres (†)				40%
		kg/km2/yr	Smaller Subwatersheds	Needed	Needed	Needed				Reduction
1	20,120	680	Allegheney River at New Kensington, PA	132,524	496,964	314,744	29,800	2.5	184,015	171.0%
2	16,010	840	Monongahela River at Braddock, PA	105,453	395,447	250,450	19,000	1.3	61,009	410.5%
3	20,320	1,060	Muskingham River at McConnelsville, OH	133,841	501,904	317,873	19,200	14.3	678,163	46.9%
4	17,100	560	Kanawha River at Winfield, WV	112,632	422,370	267,501	30,600	0.5	37,791	707.8%
5	23,330	1,750	Scioto River at Higby, OH	153,667	576,251	364,959	13,300	45.6	1,498,006	24.4%
6	19,560	1,980	Great Miami at New Baltimore, OH	128,835	483,132	305,984	9,900	46.6	1,139,510	26.9%
7	11,560	720	Kentucky River at Lockport, KY	76,142	285,532	180,837	16,000	1.5	59,280	305.1%
8	119,710	1,580	Wabash River at New Harmony, IN	788,490	2,956,837	1,872,663	75,700	53.6	10,022,074	18.7%
9	32,860	720	Cumberland River near Grand Rivers , KY	216,438	811,642	514,040	45,600	4.1	461,791	111.3%
10	49,050	470	Tennessee River near Paducah, KY	323,076	1,211,535	767,306	104,500	3.1	800,157	95.9%
11	5,030	170	Mississippi River near Royalton, MN	33,131	124,241	78,686	30,000	4	296,400	26.5%
12	53,800	1,280	Minnesota River at Jordan, MN	354,363	1,328,860	841,611	42,000	56.6	5,871,684	14.3%
13	3,690	230	St Croix River at St Croix Falls, WI	24,305	91,143	57,724	16,200	4.5	180,063	32.1%
14	9,380	400	Chippewa River at Durand, WI	61,783	231,686	146,734	23,300	6.3	362,571	40.5%
15	12,160	450	Wisconsin River at Muscoda, WI	80,094	300,352	190,223	26,900	8.9	591,343	32.2%
16	37,340	1,510	Rock River near Joslin, IL	245,946	922,298	584,122	24,700	43.8	2,672,194	21.9%
17	36,570	2,750	Cedar River at Cedar Falls, IA	240,874	903,279	572,077	12,260	70	2,119,754	27.0%
18	74,200	2,290	Iowa River at Wapello, IA (includes # 17)	488,731	1,832,740	1,160,735	32,400	65.3	5,225,828	22.2%
19	22,450	2,020	Skunk River at Augusta, IA	147,871	554,515	351,193	11,100	57.2	1,568,252	22.4%
20	27,520	3,090	Raccoon River at Van Meter, IA	181,265	679,744	430,505	8,900	73.9	1,624,544	26.5%
21	67,440	1,850	Des Moines at St Francisville, MO (includes # 20)	444,205	1,665,768	1,054,986	37,040	62.4	5,708,901	18.5%
22	66,710	3,120	Illinois River at Marseilles, IL	439,397	1,647,737	1,043,567	21,400	54.2	2,864,904	36.4%
23	78,300	1,650	Lower Illinois River Basin at Valley City, IL	515,736	1,934,010	1,224,873	47,400	63.6	7,446,161	16.4%
24	8,360	730	Kaskaskia River near Venedy Station, IL	55,065	206,492	130,778	11,400	56.8	1,599,374	8.2%
25	820	14	Milk River near Nashua, MT	5,401	20,254	12,828	57,800	0.1	14,277	89.9%
26	5,680	24	Missouri River near Culbertson, MT	37,412	140,296	88,854	237,100	0.1	58,564	151.7%
27	2,950	50	Bighorn River near Bighorn, MT	19,431	72,865	46,148	59,300	0.1	14,647	315.1%
28	11,450	64	Yellowstone River near Sidney, MT	75,417	282,815	179,116	179,000	0.2	88,426	202.6%
29	3,440	56	Cheyenne River at Cherry Creek, SD	22,658	84,968	53,813	61,900	0.2	30,579	176.0%
30	1,170	21	James River near Scotland, SD	7,706	28,899	18,303	55,800	14.6	2,012,260	0.9%
31	31,650	140	Platte River near Louisville, NE	208,468	781,755	495,112	222,200	10.9	5,982,291	8.3%
32	22,670	150	Kansas River at Desoto, KS	149,320	559,949	354,634	154,800	17.5	6,691,230	5.3%
33	22,710	1,280	Grand River near Sumner, MO	149,583	560,937	355,260	17,800	23.3	1,024,408	34.7%
34	15,410	410	Osage River below St Thomas, MO	101,501	380,627	241,064	37,600	11.8	1,095,890	22.0%
35	6,690	400	St Francis Bay at Riverfront, AR	44,065	165,243	104,654	16,800	34.6	1,435,762	7.3%
36	27,300	412	White River at Clarendon, AR	179,816	674,310	427,063	66,200	7.2	1,177,301	36.3%
37	13,920	72	Arkansas River at Tulsa, OK	91,686	343,824	217,755	193,300	5.5	2,625,981	8.3%
38	5,070	70	Canadian River at Calvin, OK	33,394	125,229	79,312	72,400	1.6	286,125	27.7%
39	18,760	605	Yazoo River at Redwood, MS	123,566	463,372	293,469	32,600	15.1	1,215,882	24.1%
40	4,420	600	Big Black River near Bovina, MS	29,113	109,174	69,144	7,300	3.7	66,715	103.6%
41	35,610	200	Red River at Alexandria, LA	234,551	879,567	557,059	174,800	2.2	949,863	58.6%
42	14,550	360	Ouachita River near Columbia, LA	95,836	359,385	227,611	40,500	1.7	170,060	133.8%
	1,076,840		TOTALS	7,092,786	26,597,948	16,845,367	2,395,800		78,014,026	21.6%
			Nine Large River Basins							
6	451,700	1150	Middle Mississippi	2,975,197	11,156,990	7,066,094	267,800			
2	244,100	630	Lower Ohio	1,607,805	6,029,270	3,818,538	274,800			
1	251,800	600	Upper Ohio	1,658,523	6,219,460	3,938,991	251,200		All land	%of All Land
5	149,800	470	Upper Mississippi	986,683	3,700,060	2,343,371	221,700		Area in	in MSRB
8	115,800	290	Lower Mississippi	762,736	2,860,260	1,811,498	184,000		MSRB	Needed for
4	166,300	180	Lower Missouri	1,095,363	4,107,610	2,601,486	521,600		Including	Combination
7	54,900	50	Arkansas	361,608	1,356,030	858,819	410,000		cropland	40% N Load
3	72,900	40	Upper Missouri	480,168	1,800,630	1,140,399	836,100		(Acres)	Reduction
	1,507,300		TOTALS for MSRB 1-8	9,928,083	37,230,310	23,579,196	2,967,200		732898400	3.2%
9	60,500	80	Red & Ouachita	398,493	1,494,350	946,422	241,700			

(†) Assumes 1/2 of Nitrogen Reduction is from Wetlands and 1/2 of Nitrogen Reduction is from Riparian Forest Zones.

Assumed Reduction capability: (a) Wetlands = 15 g-N/m2/yr (b) Forested Riparian Zones = 4 g-N/m2/yr